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## **2D and 3D Numerical Simulations of Flux Cancellation**

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*Abstract:* Cancellation of magnetic flux in the solar photosphere and chromosphere has been linked observationally and theoretically to a broad range of solar activity, from filament channel formation to CME initiation. Because this phenomenon is typically measured at only a single layer in the atmosphere, in the radial (line of sight) component of the magnetic field, the actual processes behind this observational signature are ambiguous. It is clear that reconnection is involved in some way, but the location of the reconnection sites and associated connectivity changes remain uncertain in most cases. We are using numerical modeling to demystify flux cancellation, beginning with the simplest possible configuration: a subphotospheric Lundquist flux tube surrounded by a potential field, immersed in a gravitationally stratified atmosphere, spanning many orders of magnitude in plasma beta. In this system, cancellation is driven slowly by a 2-cell circulation pattern imposed in the convection zone, such that the tops of the cells are located around the  $\beta=1$  level (i.e., the photosphere) and the flows converge and form a downdraft at the polarity inversion line; note however that no flow is imposed along the neutral line. We will present the results of 2D and 3D MHD-AMR simulations of flux cancellation, in which the flux at the photosphere begins in either an unsheared or sheared state. In all cases, a low-lying flux rope is formed by reconnection at the polarity inversion line within a few thousand seconds. The flux rope remains stable and does not rise, however, in contrast to models which do not include the presence of significant mass loading.

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**Category (Complete):** 3. Photosphere (magnetic field)